

U.S. Patent Application Serial No. 09/269,503
Amendment dated September 5, 2003
Reply to Office Action of April 7, 2003

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (Currently Amended): A liquid crystal display device, comprising:

a super twisted nematic liquid crystal cell in which nematic liquid crystal having a twist angle in the range from 180° to 270° is filled and sandwiched between a transparent first substrate having a first electrode and a transparent second substrate having a second electrode;

a retardation film provided outside said second substrate;

an absorption-type polarizing film provided outside the retardation film for absorbing light linearly polarized in ~~the~~ a direction orthogonal to ~~the~~ a transmission axis thereof;

a reflection-type polarizing film having a transmission axis and a reflection axis in a direction orthogonal to the transmission axis, provided outside said first substrate for transmitting light linearly polarized in a direction parallel to the transmission axis and reflecting light linearly polarized in the direction ~~orthogonal~~ parallel to the ~~transmission~~ reflection axis;

a light absorbing member provided outside the reflection-type polarizing film; and

a light diffusion layer provided on the outside surface of said absorption-type polarizing film,

wherein said retardation film has relations of $n_x > n_z > n_y$, where n_x is ~~the~~ a refractive index in ~~the~~ a direction of ~~the~~ a phase delay axis, n_y is ~~the~~ a refractive index in ~~the~~ a Y-axis direction, and

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n_z is the n refractive index in the z thickness direction, and

wherein ~~said reflection-type polarizing film is disposed in such a manner that the transmission axis thereof is in a direction orthogonal to or parallel with a direction of polarization of a light compensated to be a substantially linearly polarized light during passage through said absorption-type polarizing film, said retardation film, and said super twisted nematic liquid crystal cell in a state with no voltage applied~~ said retardation film and said reflection-type polarizing film constitute reflection light increasing means which increases intensity of reflected light which is transmitted from a visible side of said super twisted nematic liquid crystal cell and reflected to the visible side by said reflection-type polarizing film, to increase brightness of said reflected light, by setting the direction of the phase delay axis and a retardation value of said retardation film with respect to said super twisted nematic liquid crystal cell such that light changed into elliptically polarized light when transmitted through said absorption-type polarizing film and said retardation film from the visible side is returned to substantially linearly polarized light and outputted after further transmitted through said super twisted nematic liquid crystal cell in a state no voltage is applied thereto, and by disposing said reflection-type polarizing film such that the reflection axis thereof is in a direction parallel to or orthogonal to a polarization direction of the linearly polarized light transmitted through said super twisted nematic liquid crystal cell and outputted.

2. (Currently Amended): A liquid crystal display device, comprising:

a super twisted nematic liquid crystal cell in which nematic liquid crystal having a twist angle in the range from 180° to 270° is filled and sandwiched between a transparent first substrate having a first electrode and a transparent second substrate having a second electrode;

a twisted retardation film provided outside said second substrate;

an absorption-type polarizing film provided outside the twisted retardation film for absorbing light linearly polarized in the direction orthogonal to the transmission axis thereof;

a reflection-type polarizing film having a transmission axis and a reflection axis in a direction orthogonal to the transmission axis, provided outside said first substrate for transmitting light linearly polarized in a direction parallel to the transmission axis and reflecting light linearly polarized in the direction ~~orthogonal~~ parallel to the ~~transmission~~ reflection axis; and

a light absorbing member provided outside the reflection-type polarizing film, and

wherein ~~said reflection-type polarizing film is disposed in such a manner that the transmission axis thereof is in a direction orthogonal to or parallel with a direction of polarization of a light compensated to be a substantially linearly polarized light during passage through said absorption-type polarizing film, said twisted retardation film, and said super twisted nematic liquid crystal cell in a state with no voltage applied~~ said twisted retardation film and said reflection-type polarizing film constitute reflection light increasing means which increases intensity of reflected light which is transmitted from a visible side of said super twisted nematic liquid crystal cell and reflected to the visible side by said reflection-type polarizing film, to increase brightness of said

reflected light, by setting a lower and an upper polymer molecular alignment directions and a retardation value of said twisted retardation film with respect to said super twisted nematic liquid crystal cell such that light changed into elliptically polarized light when transmitted through said absorption-type polarizing film and said twisted retardation film from the visible side is returned to substantially linearly polarized light and outputted after further transmitted through said super twisted nematic liquid crystal cell in a state no voltage is applied thereto, and by disposing said reflection-type polarizing film such that the reflection axis thereof is in a direction parallel to or orthogonal to a polarization direction of the linearly polarized light transmitted through said super twisted nematic liquid crystal cell and outputted.

3. (Cancelled)

4. (Original): The liquid crystal display device according to claim 2, wherein a light diffusion layer is provided on the outside surface of said absorption-type polarizing film.

5. (Cancelled)

6. (Original): The liquid crystal display device according to claim 2, wherein a light diffusion sheet is provided outside said absorption-type polarizing film.

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7. (Cancelled)

8. (Original): The liquid crystal display device according to claim 2, wherein said absorption-type polarizing film is a color polarizing film using a dichromatic pigment.

9. (Cancelled)

10. (Original): The liquid crystal display device according to claim 2, wherein said light absorbing member is a color filter.

11. (Original): The liquid crystal display device according to claim 1, wherein said light absorbing member is a solar cell.

12. (Original): The liquid crystal display device according to claim 2, wherein said light absorbing member is a solar cell.

13. (Cancelled)

14. (Original): The liquid crystal display device according to claim 2, wherein said light absorbing member is a translucent absorbing member and a back light is provided outside the translucent absorbing member.

15. (Cancelled)

16. (Original): The liquid crystal display device according to claim 2, wherein a light diffusion layer is provided between said first substrate of the liquid crystal cell and said reflection-type polarizing film.

17. (Currently Amended): A liquid crystal display device, comprising:
a super twisted nematic liquid crystal cell in which nematic liquid crystal having a twist angle in the range from 180° to 270° is filled and sandwiched between a transparent first substrate having a first electrode and a transparent second substrate having a second electrode;
a retardation film provided outside said second substrate;
an absorption-type polarizing film provided outside the retardation film for absorbing light linearly polarized in ~~the~~ a direction orthogonal to ~~the~~ a transmission axis thereof;
a reflection-type polarizing film having a transmission axis and a reflection axis in a direction orthogonal to the transmission axis, provided outside said first substrate for transmitting light

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linearly polarized in a direction parallel to the transmission axis and reflecting light linearly polarized in the direction ~~orthogonal~~ parallel to the ~~transmission~~ reflection axis; and

a color filter as a light absorbing member provided outside the reflection-type polarizing film,

wherein said retardation film has relations of $n_x > n_z > n_y$, where n_x is ~~the~~ a refractive index in ~~the~~ a direction of ~~the~~ a phase delay axis, n_y is ~~the~~ a refractive index in ~~the~~ a Y-axis direction, and n_z is ~~the~~ a refractive index in ~~the~~ a thickness direction, and

~~wherein said reflection-type polarizing film is disposed in such a manner that the transmission axis thereof is in a direction orthogonal to or parallel with a direction of polarization of a light compensated to be a substantially linearly polarized light during passage through said absorption-type polarizing film, said retardation film, and said super twisted nematic liquid crystal cell in a state with no voltage applied~~ said retardation film and said reflection-type polarizing film constitute reflection light increasing means which increases intensity of reflected light which is transmitted from a visible side of said super twisted nematic liquid crystal cell and reflected to the visible side by said reflection-type polarizing film, to increase brightness of said reflected light, by setting the direction of the phase delay axis and a retardation value of said retardation film with respect to said super twisted nematic liquid crystal cell such that light changed into elliptically polarized light when transmitted through said absorption-type polarizing film and said retardation film from the visible side is returned to substantially linearly polarized light and outputted after further transmitted through said super twisted nematic liquid crystal cell in a state no voltage is

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applied thereto, and by disposing said reflection-type polarizing film such that the reflection axis thereof is in a direction parallel to or orthogonal to a polarization direction of the linearly polarized light transmitted through said super twisted nematic liquid crystal cell and outputted.

18. (Currently Amended): A liquid crystal display device, comprising:

a super twisted nematic liquid crystal cell in which nematic liquid crystal having a twist angle in the range from 180° to 270° is filled and sandwiched between a transparent first substrate having a first electrode and a transparent second substrate having a second electrode;

a retardation film provided outside said second substrate;

an absorption-type polarizing film provided outside the retardation film for absorbing light linearly polarized in ~~the~~ a direction orthogonal to ~~the~~ a transmission axis;

a reflection-type polarizing film having a transmission axis and a reflection axis in a direction orthogonal to the transmission axis, provided outside said first substrate for transmitting light linearly polarized in a direction parallel to the transmission axis and reflecting light linearly polarized in the direction ~~orthogonal~~ parallel to the ~~transmission~~ reflection axis; and

a solar cell as a light absorbing member provided outside the reflection-type polarizing film,

wherein said retardation film has relations of $n_x > n_z > n_y$, where n_x is ~~the~~ a refractive index in ~~the~~ a direction of ~~the~~ a phase delay axis, n_y is ~~the~~ a refractive index in ~~the~~ a Y-axis direction, and n_z is ~~the~~ a refractive index in ~~the~~ a thickness direction, and

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~~wherein said reflection-type polarizing film is disposed in such a manner that the transmission axis thereof is in a direction orthogonal to or parallel with a direction of polarization of a light compensated to be a substantially linearly polarized light during passage through said absorption-type polarizing film, said retardation film, and said super twisted nematic liquid crystal cell in a state with no voltage applied~~ said retardation film and said reflection-type polarizing film constitute reflection light increasing means which increases intensity of reflected light which is transmitted from a visible side of said super twisted nematic liquid crystal cell and reflected to the visible side by said reflection-type polarizing film, to increase brightness of said reflected light, by setting the direction of the phase delay axis and a retardation value of said retardation film with respect to said super twisted nematic liquid crystal cell such that light changed into elliptically polarized light when transmitted through said absorption-type polarizing film and said retardation film from the visible side is returned to substantially linearly polarized light and outputted after further transmitted through said super twisted nematic liquid crystal cell in a state no voltage is applied thereto, and by disposing said reflection-type polarizing film such that the reflection axis thereof is in a direction parallel to or orthogonal to a polarization direction of the linearly polarized light transmitted through said super twisted nematic liquid crystal cell and outputted.